Dave Medley's R-390 Compendium of Knowledge

Reposted by Lester Veenstra K1YCM/3 repost is a work in progress--patience please

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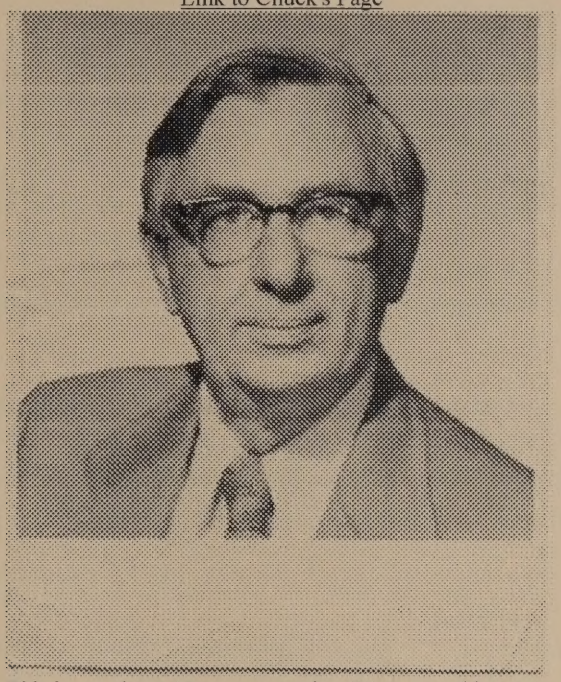
This site is devoted to the wonderful Collins R-390/URR Radio. There is some material on the R-390A but for detailed information on this equipment please refer to Chuck Rippel's Web Page.

Link to Chuck's Page



This is me about 15 years ago when I was a working man.
Now I am older and grayer and do not wear a jacket and tie!
You can contact me at:
731 West Giaconda Way
Tucson, AZ, 85704

I am happy to help anyone out there who owns an R-390 with answers to questions.

My Background

I was born in London, England on August 17, 1919 about a year after the end of world War 1. My parents were both British and my family roots have been traced back to the Norman conquest in 1066. My parents migrated to Australia in early 1920 and that is where I was brought up and educated. I graduated from the University of Melbourne with an MS degree in Physics and Mathematics in 1941. I joined the Royal Australian Navy at this time and was involved in the first landings on Guadalcanal in 1942. I barely escaped this episode with my life as the ship I was serving on was sunk by the Japanese in August 1942. After the end of the war I taught Physics at the University of Melbourne for a year and then joined the Department of Civil Aviation as an Engineer. In the next 10 years I rose to the position of Chief Engineer and in 1958 I was sent to Montreal as the Australian Representative on the Council of the International Civil Aviation Organization. I spent 5 years here and played a prominent part in the drafting of new Civil Air Regulations. For one year I chaired the United Nations Joint Staff Pension Board which was an interesting experience. It was during this time that I met executives from the Collins Radio Company and I was pressured by them to join Collins. However I felt obligated to return to Australia which I did in 1962. I was unhappy with many things that I found there and so I wrote to Collins and asked if they still wanted me. The answer was Yes so we retuned to the USA in 1963 and I became a citizen in 1969. I worked with Collins and Rockwell until 1979 when I retired. For the last 5 years with them I was Director of Marketing for Latin America. At this time Rockwell hired me back as a consultant for two years and then I was enticed to a new Company called USTel in Dallas. This company eventually joined with GTE and became US Sprint. USTel talked me into going back to work full time as the VP Operations of one of their subsidiaries. I finally retired in 1985 and now live in Edgecliff Village, near Fort Worth, Texas. I have 2 children,

R-390/R-390A AGC - Ending The Moment Of Silence
The Way They Should Have Done It
By David Wise

Ending The Moment Of Silence Easy front-panel wiring change involving a new terminal strip, a couple caps and resistors, and a new AGC switch.

- No more silence or blasting.
- No side effects.
- Compatible with all IF decks, no deck changes needed.
- Can be done on the R-390 but not quite as neat mechanically.

PRINCIPLES

Collins designed three AGC rates into the R-390, and carried the circuit forward to the R-390A with no change. FAST is a couple of 0.1uF caps, for a time constant of about 0.015 second. MED is a 2uF cap, which gives you about 0.5 second. SLOW multiplies the 2uF cap by about 15* by stringing it across a triode, from plate to grid. Any time the grid moves, the plate moves in the opposite direction about 14 times as much. With 15 times as much charge moving through the cap, to the AGC bus it looks 15 times as big.

* Please understand that due to the nonlinear transfer characteristic of V506, this number is approximate.

This is the next-cheapest possible way to get the SLOW time constant. Since the R-390 IF and RF amplifiers do not load the AGC bus, they could have simply switched in a big series resistor. Either grid current was a concern, the Carrier meter created a compelling argument for the time constant tube, or they anticipated the R-390A's RF deck voltage divider, R201 and R234.

ORIGINAL DESIGN (Figure 1)

Refer to Figure 1, an IF deck schematic excerpt from the Y2K Manual. The cap, C551, has one end connected to V506A's grid, which is also the AGC bus. The other end goes out to S107's rotor on the front panel. There, the MED position grounds it while the SLOW position routes it back to V506A's plate. The plate goes to B+ 205V through R549 (82k).

When the grid is at 0V (no signal), V506A conducts about 2mA of plate current, pulling the plate down to about 27V. At -20V AGC, the tube is cut off and the plate is at +205.

THE PROBLEM

The grid end of C551 is on the AGC bus. At MEDium speed, the other end is grounded. In SLOW, however, the other end is anywhere from +27 to +205. Obviously the cap has to charge up to get there, by dumping [conventional] current onto the AGC bus, which forces it positive and causes a huge signal overload. I call this the "Blast".

If not for two ameliorating factors*, it would last 15 times as long as the MOS because of the multiplication effect.

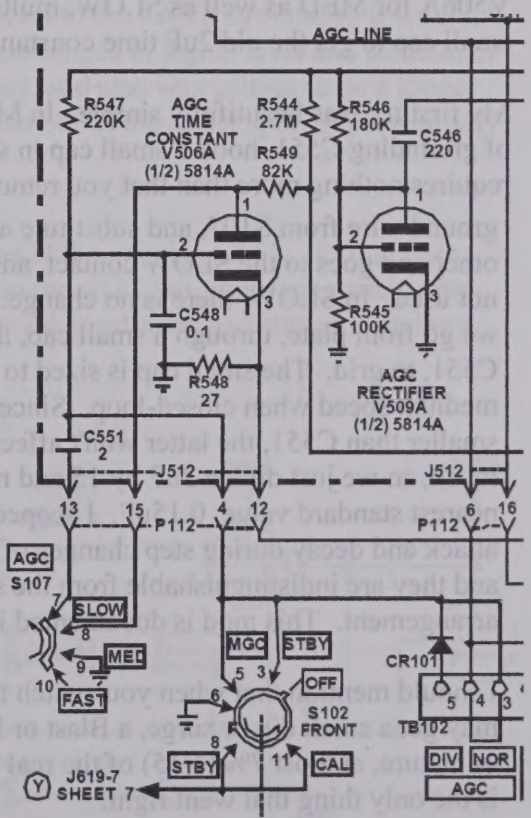


Figure 1

* First, until V506A gets out of saturation, its grid is driven positive, draws current, and charges the cap more quickly. Second, R545 is bypassed by the AGC rectifier. (IF decks with the Lankford AGC mod will be even faster, limited by the rectifier's effective impedance of around 7k.)

Now switch back to MED. The non-grid end of C551 instantly goes from a large positive voltage (+27 to +205) to ground, which forces the AGC bus negative by the same amount. We're talking up to -200V or ten times max. Every tube cuts off hard until this charge drains away. This is the well-known "Moment of Silence".

These effects are intrinsic to the dual use of C551. In MED, it has X volts, while SLOW gives it 10*X. While switching circuitry could force the cap to the correct charge level as the switch moved between detents, it would be quite complex and utterly out of the question.

IDEA THE FIRST

The only feasible solution is to use separate caps for MED and SLOW.

The brute-force approach is to add a second 2uF cap, and use one for MED and the other for SLOW. However, C551 is a big, expensive cap, and Collins would not have sprung for a second one, even on a Government contract.

IDEA THE SECOND

And rightly so, it's not necessary. We could use V506A for MED as well as SLOW, multiplying a small cap to get the old 2uF time constant.

My first try was beautifully simple. In MED, instead of grounding C551, hook a small cap in series, which requires nothing more than that you remove the ground wire from S107, and substitute a cap. The other end goes to the SLOW contact, and ground is not used. In SLOW, there is no change. In MED, we go from plate, through a small cap, then through C551, to grid. The small cap is sized to give medium speed when closed-loop. Since it's much smaller than C551, the latter won't affect the total much, so we just divide 2uF by 15 and round to the nearest standard value: 0.15uF. I scoped AGC attack and decay during step changes of signal level, and they are indistinguishable from the stock arrangement. This mod is documented in Figure 2.

I should mention that when you switch to MED, you may get a small dip or surge, a Blast or MOS in miniature, at most 7% (1/15) of the real thing. This is the only thing that went right.

Figure 2

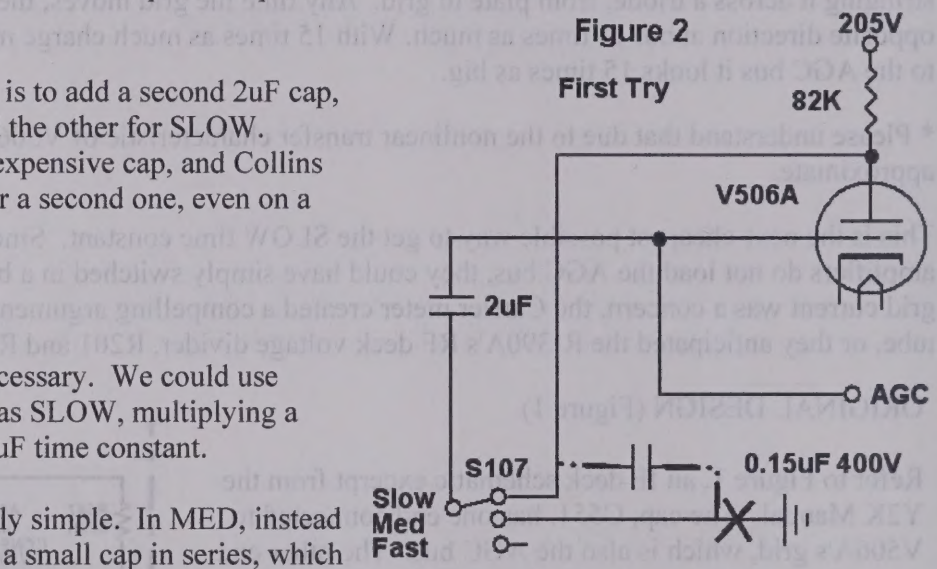
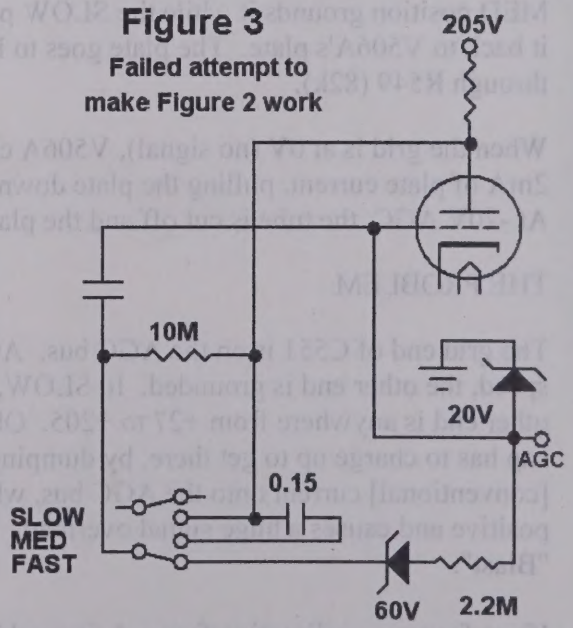


Figure 3



NOT SO FAST

This works as advertised - until you meet the real world. There is a huge bug lurking. Let's say you've been listening to BBC at +60dB. Your "favourite programme" ends, and you go hunting, switching to FAST so as not to miss anything while you scan. Down in the mud you hear something, but it's fluttery. You switch back to SLOW to smooth it out --- and all goes silent. It's the Moment all over again, but it goes on and on. Finally, after maybe ten seconds you can hear again, and your quarry's gone off the air. What happened? When you were on BBC, C551 was sitting at about -10 on the grid and about +100 on the plate. When you went FAST, it was disconnected. Since you have conscientiously installed a nice new cap, it holds its charge. Your new signal is very weak. You go back to SLOW, and Pow! the stored charge slams the AGC bus right back to -10. Not only that, you're on the SLOW time constant, so it takes 15 times as long to get back to equilibrium.

It works the other way too. Let's say, instead of going to a program you don't like, BBC went off the air. You sit mulling over what you've heard, until the static comes up. You go to FAST, hit another good powerhouse, and go back to SLOW so the Debussy doesn't get clobbered by the fades. *Blast* goes the audio as you endure seconds of overload. It's shorter than usual (C551 starts at +27V instead of 0), but still -- we were trying to eradicate this nonsense, weren't we? We've just made it better some ways, worse others, and unpredictable to boot.

IT'S SUPPOSED TO BE AUTOMATIC BUT ACTUALLY YOU HAVE TO PRESS THIS BUTTON

I tried a couple of embellishments on this mod. I was reluctant to give it up outright, because as far as I can see it is very much the simplest possible mod. The problem is charge storage on C551. First I tried to gradually leak it off to the right value with a bleed resistor. This was doomed, because if you make the R-C551 time constant less than about 20 seconds (and you must, if it's to be useful), there is a noticeable AGC offset until the cap reaches equilibrium.

Then I added a zener diode to limit the stored charge (connected to the FAST terminal so it wouldn't disturb MED or SLOW operation), but it only works in certain ranges of signal level and sometimes only if you switch speeds at certain narrowly-defined intervals, and also was getting to be a kluge, see Figure 3. I even entertained a "Dump AGC" button. I was out of the sweet spot, to put it mildly.

EXODUS

At this point I concluded that I had exhausted the possibilities of the existing C551. It's that darn grid connection in the IF deck. As long as C551 is shackled to the AGC bus, you can't manage its charge without also distorting the AGC. I mentally threw out all constraints and started sketching, just to see where it would take me.

A NEW HOPE

The first sketch is reproduced in Figure 4. It uses a 4-pole switch for maximum flexibility. The big idea here is that when a cap is not being used for AGC, we hold it at the same potential it would have if it were.

That way, when we switch it in, there's no bump. A new cathode follower (don't panic, this is a gedankenexperiment) isolates the unused cap from the V506A plate to eliminate all chance of interaction.

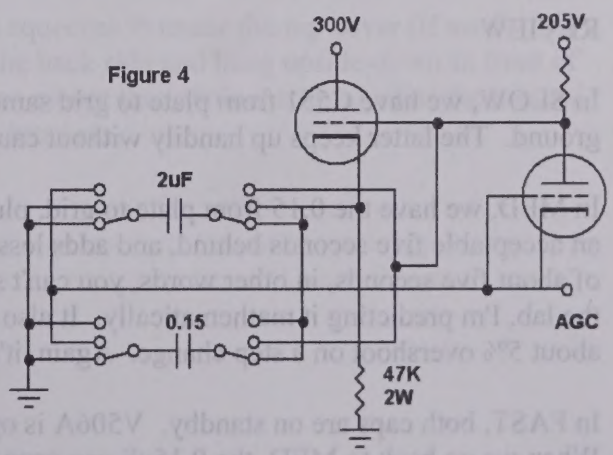


Figure 4

Even so, we only partly achieve the ideal. To go all the way, we'd need a second cathode follower plus a regulated negative supply, to isolate the grid end of the caps from the AGC bus. As it is, we get a compromise. The cathode follower output is maybe five volts above its grid, so when the AGC is around five volts, we're perfect. We're never more than 15 volts off, which causes a short, mild, fairly innocuous correction because it's divided by 15.

THE REAL DEAL

Of course, adding a cathode follower is out of the question. In fact, any kind of follower, because we don't have a supply higher than +205. Yes, there is one on the audio deck, but I wasn't about to route it to where I would use it. Too much of a kluge, again. I took another leap of faith and erased it. Since the high ends of the caps were now permanently connected to V506A's plate, I could throw out two switch poles. Getting warm, but what about interaction?

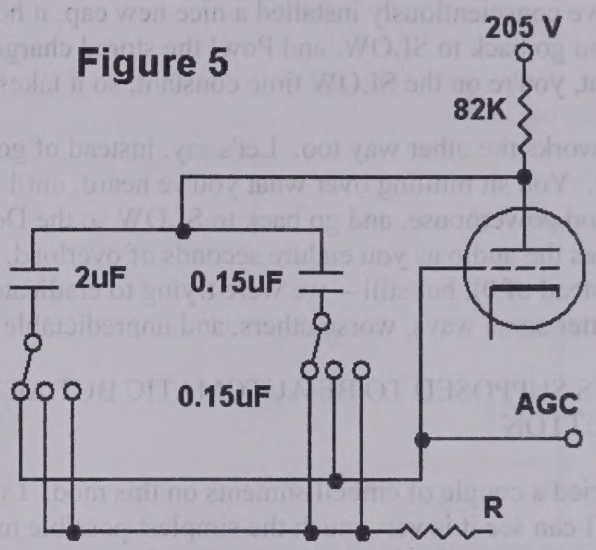


Figure 5

The worst case is MED, where my 0.15uF cap is active and C551 is on standby. Picture a step change in signal. At V506, the grid and plate voltages, formerly steady, would abruptly start to rise or fall. At medium speed, the design time constant is about 0.5 second. Hang a 2uF cap off the plate, it will try to hold the plate steady, which reduces the feedback effect and therefore the effective capacitance. Add capacitor, it speeds up: not exactly intuitive.

Could I use a resistor to isolate the standby cap, and still get what I wanted? I wired it up as in Figure 5. As expected, R=0 threw the medium time constant way off. As I increased it the TC came back to normal. At 470k, I couldn't see any effect, so I sat back and took stock. The V506A plate load is 82k, but the impedance seen by C551 is 82k in parallel with the tube's plate resistance, which is only about 20k. The 470k isolation resistor is more than 20 times that, confirming my observation of no significant interference. What about the standby cap? If it's 2uF, it's on about a one-second time constant, in other words, if the signal holds constant for five seconds, we're right on. That's perfectly reasonable. Any time C551 is out of equilibrium, the charge or discharge current offsets the plate voltage, but the effect on the grid is tiny. The plate offset was small (15/485), and it's divided further by the tube gain. The 0.5-second MED time constant cuts it even further. By George, I think we've got it!

REVIEW

In SLOW, we have C551 from plate to grid same as usual, plus a 470k - 0.15uF series combo to ground. The latter keeps up handily without causing trouble.

In MED, we have the 0.15 from plate to grid, plus a 470k - 2uF series combo to ground. The latter is an acceptable five seconds behind, and adds less than 0.3% AGC offset which decays over a period of about five seconds, in other words, you can't see it outside the lab. Heck, I couldn't see it *inside* the lab, I'm predicting it mathematically. It also affects the meter ballistics slightly, eyeballed at about 5% overshoot on a step change. Again, it's undetectable against a real-world signal.

In FAST, both caps are on standby. V506A is open-loop, so this only affects the meter ballistics. When we go back to MED, the 0.15uF cap goes active, highlighting a small problem.

It was directly in parallel with C551 and therefore five seconds behind. If we rearrange the 470k resistor slightly, FAST will connect the 0.15uF cap straight to ground. This also allows you to use one of the switch terminals as a tie point. The incremental ballistic effect is small and in my opinion quite worth the convenience. You could also use two separate resistors, but you need a tie point.

On switching FAST-MED, MED-SLOW, and SLOW-MED, the cap being brought online has a potential equal to V506A's plate voltage. If there is enough signal to generate AGC voltage, it is not part of the cap's potential, and the AGC bus will experience a positive step. It's very small, because the error is inside the feedback loop and gets divided by the tube gain. For example, with a 16V error, the grid (i.e., the AGC bus) goes up 1V and the plate goes down 15.

ONE LAST THING

This is how Collins should have done it. The cost delta would have been: one resistor, 2-pole vs 1-pole switch and one additional 0.15uF 400V Vitamin Q cap

I am not a genius. All I can figure is, the engineer assigned this task was mediocre, inexperienced, unimaginative, or just pressed for time.

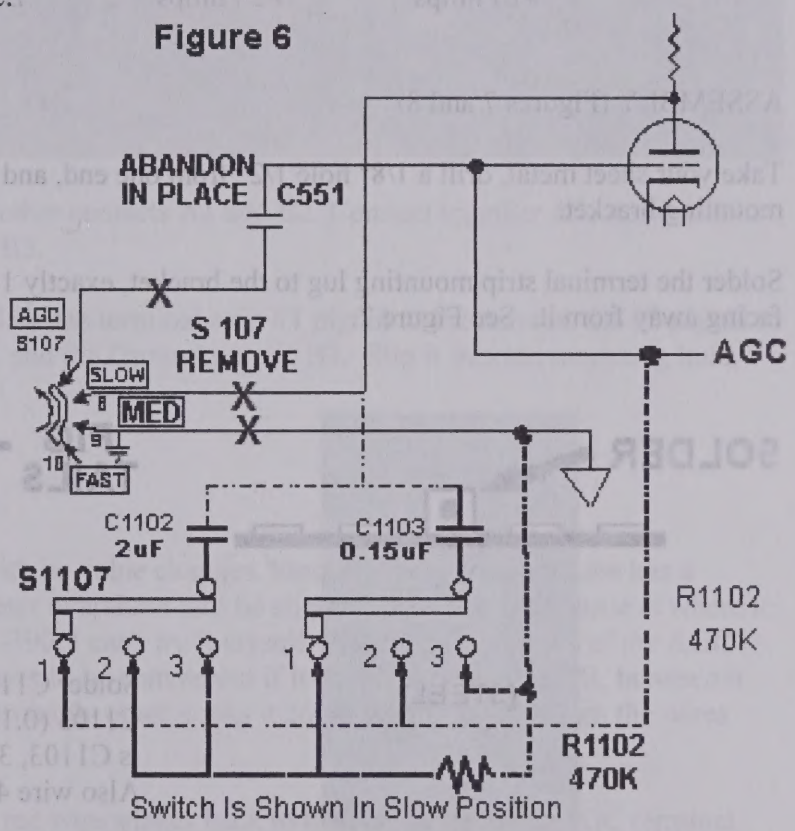
I changed S107 on the front panel. I was loath to also modify the IF deck, but the only way to avoid it is to abandon C551 and add my own 2uF cap on the front panel.

In Figure 6 I call it C1102 (C551, version 2). Provided we can find a place for it, we have a viable mod.

FITTING IT IN

Where to put our new caps? Since we're already replacing S107, the open space between it and the ANT TRIM shaft is a prime candidate. How much space do we need? The DigiKey catalog lists six different 2.0 or 2.2/400 caps. They're all less than 2" x 1-1/4" x 1-1/4".

Figure 6



Switch Is Shown In Slow Position

If we elevate a cap this size to where it doesn't quite graze the tallest nearby gear, it squeezes in under the top cover (if used). Let's mount it on a terminal strip. Then C1103 can go on the back side and hang upside-down in front of the gear. To avoid gluing or drilling the panel, we can mount the terminal strip to a flat sheet-metal bracket anchored under the terminal board mounting bracket.

PARTS LIST

Piece of 22ga sheet steel, 1" by 2-1/4".

Terminal strip, Radio Shack #274-688 (5-lug) or similar

470k resistor

0.15uF/400V capacitor, NTE MLR154K630 or similar*

2.0uF/400V capacitor, NTE MLR205K400 or similar**

2-pole 3-position rotary switch

A couple feet of wire

* It only needs to be 400V, but with NTE, the 630V model has more convenient lead spacing.
** 2.2uF is fine too; there are six available from DigiKey, they're all small enough, and several are cheaper.

TOOLS

Vise & hacksaw	Sandpaper	Drill
#1 Philips	#2 Philips	Dikes, stripper, soldering iron

ASSEMBLY (Figures 7 and 8)

Take your sheet metal, drill a 1/8" hole 1/2" from one end, and sand the other half bright. This is our mounting bracket.

Solder the terminal strip mounting lug to the bracket, exactly 1-1/2" from the hole, with the strip facing away from it. See Figure 7.

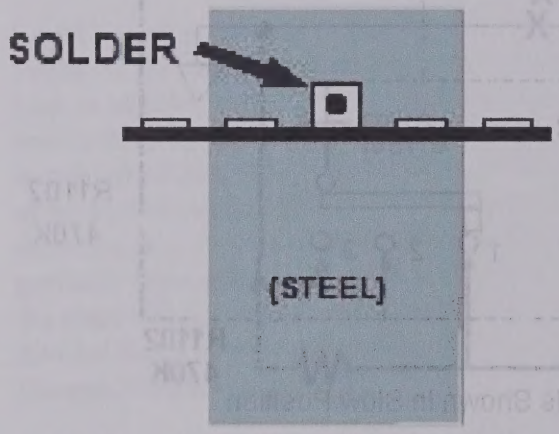
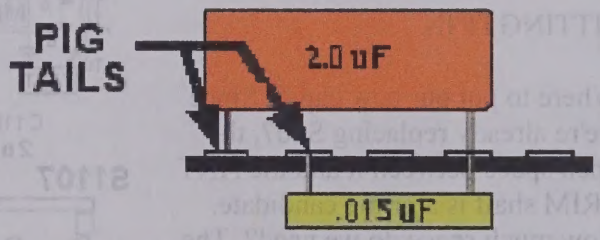


Figure 7



Solder C1102 (2uF) on the "normal" side, and C1103 (0.15uF) on the back. Lug 1 is C1102, 2 is C1103, 3 is unused, 4 is common to both caps. Also wire 4 to 5.

Figure 8

Solder 4" pigtails to lugs 1 and 2. They will go to the A and B rotors on S1107. The wire from the S107 SLOW contact (V506A plate, white with green and orange traces in my radio) will go to lug 5

Drop the front panel and solder a 6" pigtail to the MGC/STBY contacts on the S102 FUNCTION switch (front wafer, two adjacent contacts wired together). Route this wire, AGC, up near S107 and temporarily tape it down. Replace the front panel.

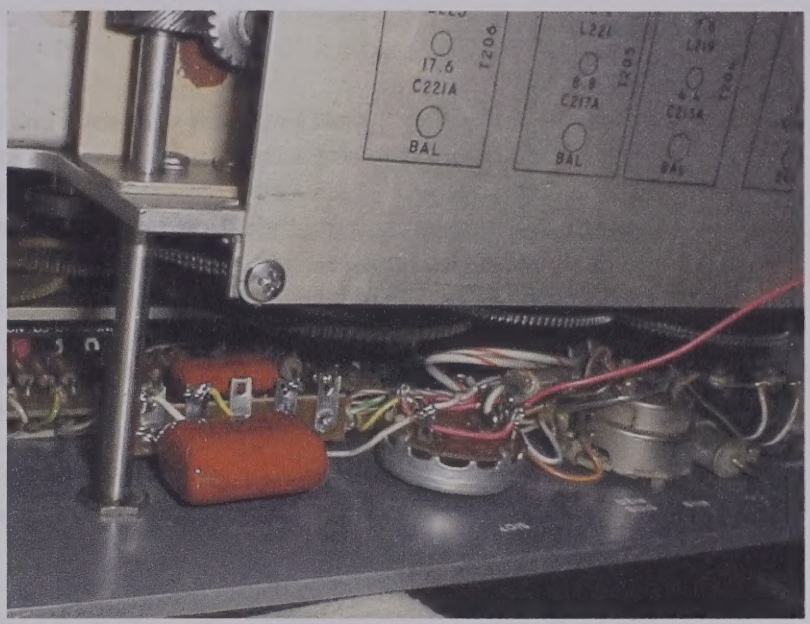
Remove the nameplate, exposing the Terminal Board screws. Loosen the left-hand one, remove the right, slide our bracket under the TB bracket, and replace the screw, through our bracket. Tighten them up, and replace the nameplate.

Disconnect the wires on S107.

The one on the rotor is C551. Tape it off, you won't use it.

The one on the SLOW contact is Plate, solder it to terminal strip lug 5.

The MED contact is Ground, it will go to S1107. Remove and archive S107.



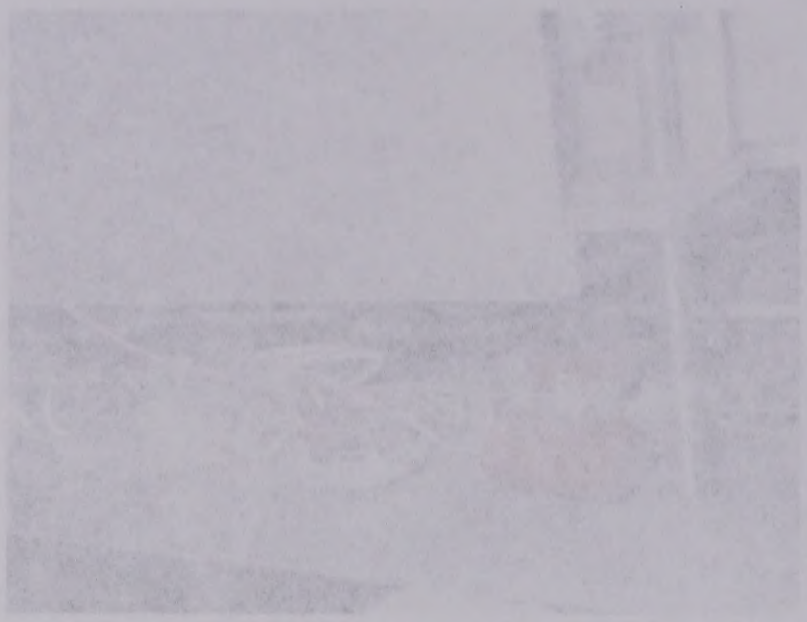
With S1107 on the bench, connect together contacts A1 and B2. Connect together A2, A3, and B1. Solder R1107 (470k) between B1 and B3.

With S1107 behind the front panel, solder the terminal strip #1 pigtail to the A rotor, the #2 pigtail to the B rotor, the AGC pigtail to A1/B2, and the Ground wire to B3. Slip it into the mounting hole, bolt it down, and you're done.

THE R-390

Electrically, the mod can be applied with no value changes. Since the time constant tube has a smaller plate load (56k vs 82k), the meter overshoot will be slightly less. The main issue is where to fit the terminal strip. Not having an R-390, I can't try it myself. It can't go to the left of the AGC switch, the terminal board is there. It would be convenient if it could go below the TB, between it and the frequency readout. There are probably other nooks it could be fit into, although the wires would be longer.

Note: I didn't drop the front panel; the red wire snakes back to the rear panel to the AGC terminal.



Solid-State Those Pilot Lamps
By Phil Salas – AD5X

Introduction

As I'm sure you know, many old and even new brands of ham gear use the popular #44, #47, and #51 pilot lamps. My latest restoration project, a Johnson Ranger, has five 6.3VAC pilot lamps, each drawing 250 milliamps, for a total of 8-watts dissipated power. And three of the pilot lamps are enclosed in impossible to replace items on the Ranger – namely the dial (two lamps) and the meter (one lamp). Long-term exposure to the approximately 1.5 watts per lamp of heat in these enclosed places was a concern to me.

All Electronics (www.allelectronics.com) sells 5 mm 3000 mcd white LEDs for $2 each (LED-75). These are three times brighter than the original Ranger pilot lamps. However, LEDs do have a narrow viewing range so they can normally only be used when the lamp is mounted such that the LED faces forward. In the three enclosed pilot lamps of the Ranger, the pilot lamps do face forward so these would be perfect for LED replacements.

Making the LED Pilot Lamps

First of all, most of the ultra-bright LEDs have normal operating currents of about 20 milliamps. In order to properly set this current, I put a 500-ohm pot in series with a 6.3VAC source and measured the current on a multi-meter. Remember that LEDs are diodes, so they rectify the AC voltage and therefore LED polarity doesn't matter (obviously polarity does matter if the LED is driven from a DC voltage source). Using this methodology, I determined the series resistors necessary to provide 20 milliamps from a 6.3VAC source for most ultra-bright LEDs is as shown in Table 1 below:

Table 1

LED	Fwd Voltage	Series Resistor
White	4V	82 ohms
Green	3V	100 ohms
Amber	3V	100 ohms
Blue	3V	100 ohms
Red	2V	120 ohms

Depending on your particular LEDs, LED current, and voltage sources, you should probably make this same measurement to ensure that you pick the correct dropping resistor for your application. Incidentally, when using AC sources, it is best to either put a second LED reversed across the first LED, or connect a diode across the LED as shown in the schematics. The reason is that the maximum reverse voltage is only around 5-6 volts, and most AC sources can exceed this. So a second LED (which will double the output) or a diode will restrict the reverse voltage applied to the LED to a safe value. I didn't worry about this for my 6.3VAC source and haven't had any problems, but I would certainly do it for higher AC voltages.

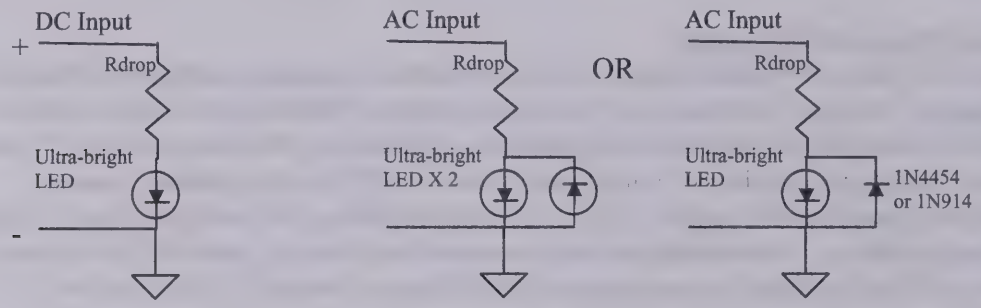
Building a pilot lamp substitute is easily done if you can build the ultra-bright LED and dropping resistor directly into the associated pilot lamp socket. In my case, the pilot

lamps all used bayonet bases. I chose to purchase some #47 bulbs (All Electronics #LP-47 @ 2/$1.00) and sacrifice them for this purpose.

To prepare the LED-lamp base, do the following:

1) Put on safety glasses!
2) Wrap the pilot lamp in a small plastic sandwich bag and gently crush the glass part with pliers.
3) Using the pliers, gently squeeze and rotate the base. This should break up the remainder of the glass in the base. When through, ensure that the base is as round as possible.
4) Shake out the glass, and then use a solder-sucker to remove the solder from the tip of the base.
5) Using needle nose pliers, pull the remaining pieces of bulb and wiring out of the base. If necessary, re-use the solder-sucker to clear out any remaining solder.

The schematic circuits are pretty simple.



Gather up the necessary parts. In my case, I used the 3000 mcd ultra-bright white LEDs discussed earlier with a ¼-watt 82-ohm series resistor. Refer to the first photo.

Now, cut one lead of the resistor, and one lead of the LED to 1/8-inch. Overlap these short leads and solder them together. The use of one of those desk-top "helping hands" is great for holding these parts together while soldering. Now bend the remaining LED lead over and up as seen in the second photo.

Insert the long resistor lead though the hole in the base until the body of the resistor bottoms out in the base. Solder the resistor lead in place. Now solder the bent-up LED lead to the side of the lamp base. If you'd like, you can fill the base with epoxy or hot-glue to give it some stability. I didn't find this necessary. Clip off excess lead lengths and you're done. Refer to the last photo. Now you can just insert these LED Pilot Lamps into the original pilot lamp sockets. You've decreased the current drain by at least a factor of 10, and significantly increased the reliability of the lamp. In most cases, the intensity will be noticeably brighter.

The Other Two Ranger Lamps

The remaining two lamps ("ON" and "TRANSMIT") used in the Johnson Ranger mount vertically behind the front panel, and the light is actually picked up from the side of the lamps and transmitted through two jewel assemblies to the front. These jewel assemblies

have an inside diameter of 5 mm, therefore the 5 mm ultra-bright LEDs wound up fitting tightly into these assemblies. Since the jewels have red lenses, I went ahead and used lower cost ultra-bright red LEDs for these two locations (All Electronics LED-94 @ $0.75 ea). As it turned out, these LEDs were too bright at the full 20 milliamps of current! To get the brightness to that of the original pilot lamps, I soldered a 1K-ohm series resistor from the applicable 6.3VAC source to one lead of each LED, and a ground wire to the other lead of each LED.

Conclusion

Building LED replacement lamps for normal incandescent pilot lamps is not difficult, and no longer expensive due to the improved prices on ultra-bright LEDs. You'll probably never have to replace a pilot lamp again after making this conversion.

Date: Tue, 12 Jan 1999 10:35:39 -0600
From: "A. B. Bonds" <ab@vuse.vanderbilt.edu>
Subject: [R-390] On taking down the R-390 gear train

RF Gear Train Surgery for the R390

A. B. Bonds, Nashville, TN, 1/11/99

In units as old as most R-390's, there has been ample opportunity for the lubricants to turn into peanut butter, or even concrete. Hardened grease is not easily removed, and because the gear train is so closely integrated with the RF module, providing adequate delivery of solvents can be tricky. This ultimately leads to the chilling prospect of disassembling the gear train for thorough cleaning. Having just accomplished this task, I will describe the experience and offer a few tips. Though not for the complete fumble-fingers, it is not impossible if you have a reasonably steady hand, a clean workspace and some common sense.

Up front: Ya gotta have the manual. I used TO 31R1-2URR-412, pp 77-91 plus other random figures. _Don't try this without_. Also, plan on the whole process taking on the order of 6 hours, not counting resynchronization. Have a large clean table to work on, with a clean, hard floor for a few feet around. It can get very ugly trying to find little parts in carpet. Get a box of baggies. Marking is important. At least have a Sharpie pen; I used a Dremel engraving tool (it doesn't get wiped off with the solvent). In addition to the usual tools, you will need a very fine pair of snap ring pliers and some small pin punches to drift out roll and taper pins. You also will need a REAL Phillips head screwdriver of high quality and some solvent, such as carb cleaner or acetone. Note also that the process can mess up things like the BFO and Antenna Trim settings unless you are very careful, so a number of adjustments have to be done after putting things back together.

Step the first: Remove the front panel. To do so, take off the knobs that are attached to shafts that go through the panel. This includes Bandwidth, BFO pitch, KC and MC change, Antenna Trim, dial lock and zero adjust. The KC and MC change knobs are held on by internal clamps whose screws are NOT centered. The access holes are slightly offset--use this as a guide to find the socket for your Bristol wrench. Loosen the dial lock nut until the whole lock can be rotated out of the way of the tuning disk. Remove the handles and the four Philips screws holding the front on. Lift the front of the receiver and prop it up on something. I used a couple of small chunks of 2 x 4. This is important, since the cabling

attached to the front panel is short, and the lower edge of the panel must go under the receiver in order to lay it down flat. Gently pull the panel forward over the shafts. The Antenna Trim shaft is plastic or phenolic that can be deformed by the pressure from the knob screw. It can hang up in its bushing. Don't force this, simply remove the bushing from the panel, and leave it on the shaft. Now the panel can be brought free and laid down.

The next step is removal of the RF module. The book describes this pretty well. Basically it involves removing the lid, unplugging a mess of cables and loosening three Phillips anchor screws. Note also that the shaft that drives the crystal oscillator must be disconnected. When you do this, the Oldham coupler falls loose. This is a good use for your first Baggie.

The entire assembly then lifts out. Note that it can't easily be set down right side up due to the gears sticking out the bottom--get used to laying it down upside-down. Also note clearly that by removing the RF unit, the anti-backlash gears on the two main tuning shafts are relieved. This means that their springs can escape and go walkabout. Mine were held pretty tightly, but I put some masking tape around them just in case.

This first disassembly step is to remove the eight slug racks. This has to be done with the unit right side up, so find a guest towel or other suitable padding to set the unit on. Unhook the springs of each rack and pull it straight out. NUMBER THE RACKS. You can't get messed up regarding which end you started on since the ends are different, but do number them 1-8 or by the band they serve. NOTE THAT the 0.5-1MHz band is not on the end, rather the 1-2 MHz band occupies that space. You can read the band on the side of the coil cans. The springs should be completely removed. If not, they will fall out and you'll lose them. Time for baggie # 2, and count the springs as you put them in for assurance.

Now set the RF unit on your bench. You will first remove the clutch. Remove the Phillips screw holding the clutch shaft to the front plate and loosen the pot nut, which permits you to lift the clutch assembly out. You do NOT have to disassemble the clutch, and I don't recommend it, since it is a bear to get back together due to the strong springs inside. You can take off the friction bar and wash the clutch out pretty thoroughly, just don't undo the snap rings. Take off the counter, but there seems little point in removing the bevel gears from the counter. In general, the counters are in pretty good shape, though they

can use
delicate lubing with fine oil on the mainshaft and the transfer shaft. The bevel
drive gears can then be drawn off the front plate and you can clean the shafts.
Remove the green (offset) gear by taking out the Phillips screw. At this point I
started labelling the gears with the engraver, using the code numbers from Fig. 73.

The other brass gear on the front panel can now be removed by pulling its E-ring.
Baggie time. Removing another E-ring and a small spring pin lets you slide out the
shaft/brass gear assembly (Baggie, etc). Now the front plate can be removed by
taking off the obvious screws.

At this point I will defer to the book, which is reasonably clear. However, a few
other comments are in order. (1) It is NOT necessary and downright inadvisable
to disassemble the differential gear assembly. It has lots of little pieces, but they
are all accessible for cleaning. If you soak it in a solvent for a couple of hours,
that's much easier than chasing invisible parts for a similar period. (2) Step #30
blithely says, "Remove the three 4-40 Phillips head screws to remove the steel split
gear assembly." The green goop on the heads of these screws is Thermonuclear
LocTite. BE SURE to have a Phillips head screwdriver that fits these screws snugly
and properly, and don't let it slip. If it slips, the only way to remove these screws
is to machine the sides flat with a Dremel tool and grab 'em with pliers. (Is this
the voice of experience talking??) (3) Just when you think you are off the hook,
you get to instruction #31: "Remove the No. 6/0 taper pin from the first variable if
rear cam." Now, the theory behind taper pins is, once they are stuck, they don't
get unstuck, and you can count on it. First, MAKE SURE you know which end is
the small end. They don't come out if you mash on the big end. Second, find a
pin punch that is just a tad smaller than the small end. Use a quality tool, a nail
doesn't hack it here. A small hammer helps resist the delivery of impatient force,
but a big hammer might be necessary in the end. Unless you are a glutton for
punishment, this is the ONLY taper pin you need to attack. The remaining cams
can be left on their shafts, unless you have a real rustbag of a unit.

(4) Instruction # 34 describes the removal of the Geneva system. This gizmo
magically advances the bandswitch the right amount at the right time. There is a
loose 3/16" ball in the mechanism, don't lose it. Another baggy. You may want
to do step #35 to clear the remaining gears from the rear plate.

This is about the last thing you really need to do unless you want to pull the Oldham coupler shaft. At this point, all that is left on the RF unit is the set of cams and shafts. It can be wiped down with solvent and the bearings can be cleared. I used a spray can of carb cleaner (mostly acetone and other light hydrocarbons) to blast out the old crud from the bearings, then relubed with a needle-point oil injector.

You can now get to work doing the detailed cleaning on the removed gears. I have an automotive parts washer in the basement which proved very handy, dropped them into a screen can and let them soak overnight. You will still have to attack stubborn impacted deposits with a soft wire brush or toothbrush. After removing the washer solvent and drying, I checked the rotational looseness of the split gears. Some were a bit stiff, so I sprayed carb cleaner into the gap between the gears until they broke free. A bit of fine oil was then applied. Don't forget to clean the rollers on the slug racks, the cam edges and the inside edges of the slots for the racks on the RF deck. The lube to use on the gear and sliding surfaces has been discussed previously in this group, with a host of suggestions.

Reassembly, as they say is the reverse of disassembly. If you did not remove the camshafts, you can start around instruction # 15. One very nasty bit is proper installation of the Geneva mechanism. Instruction #17 warns "The alignment must be precise so that the assembly will function properly". What they mean is that it is hard to get the system to stay properly assembled when threading the shaft into the hole in the plate. The front plate of the mechanism (#129, Fig. 73) has a keyway that aligns it on the shaft to prevent it from turning. The problem is keeping the plate aligned with the keyway on the shaft while offering the shaft to its anchor hole at an angle, which is required by the position of the mechanism.
One way I found to do this was to remove the small gear that is adjacent to the mechanism (undo the E-ring and slide the gear off), which reduces the angle with which the mechanism must be brought in. When the mechanism is installed, all of the parts should align in parallel and there should be very little lateral slop. If the brass part slides back and forth on the shaft, it is improperly installed.

The remainder of the reassembly goes without incident if you don't mind chasing around for those pesky snap rings that sproing off now and then. Step # 49 involves synchronization of the Geneva mechanism. When 49(c) says "clockwise" it would seem that this is meant as viewed from the rear, and similarly for

49(e).
These settings are only approximate. The ultimate adjustment of the gears involved in this adjustment will depend upon the bandswitch positioning.

The bandswitch rotors have two contacts about 90 degrees apart from one another. To set the bandswitch, you want to start with the two contacts facing "up" like a V as the RF unit sits on your bench upside down. While most of the wafers will do for observation, I found it convenient to adjust by watching the fourth from the rear as viewed from the front of the RF assembly. In step 50, one rotates the bandswitch so that the RIGHT rotor contact is under the stationary contact that is next to (just above) the bottom one on the right when the counter registers 00 MHz (the bottom contact being the main wiper, always engaged). Then by rotating the rear portion of the gear 63, one can see the switch rotor move to the next contact (up) for one notch of advance (to 01), then the next contact (up) for two notches of advance. The counter should now read 03. On the next notch, the switch shifts to the left set of contacts for 04-07, 08-15 and 16-31. Note that the switch probably won't be properly aligned for all of these settings. You have to use common sense here. Go back to the original clamps that were adjusted in instruction #49 and mess with them. After a while, the pattern will emerge. I don't think you can get perfect alignment for all positions, but it is not terribly hard to make reasonable contact. Note that sometimes the Geneva mechanism does not advance fully for a given "notch" of gear advance, but if you overshoot slightly it will kick the mechanism into correct position. The goal of the game is to minimize this motion on overshoot for all positions, running both forward and backward.

The remainder of the synchronization is pretty straightforward, using the photograph of Fig. 44 (page 91) as a guide. The physical position of the crystal oscillator Oldham coupler is immaterial, that will be adjusted when you replace the RF unit. Unless you have been careful not to move any shafts, you will also have to reposition the Antenna Trim and BFO controls.

Good luck, and happy listening!

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Submissions r-390@qth.net

End of r-390-digest V1 #204
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[R-390] R390A RF Deck slug indentification

Flowertime01 at wmconnect.com Flowertime01 at wmconnect.com
Sun May 17 15:27:36 EDT 2009

- Previous message: [R-390] R-390A/R-1247 Data Plates follow up
- Next message: [R-390] R390A Non-working BFO fix
- **Messages sorted by:** [date] [thread] [subject] [author]

Brian,

Slugs popped up just last month as a topic.

The R390/A has just two types of slugs. One type in all 8 octaves of the RF section 3 x8 = 24. Type two is in the variable IF section of the RF deck. These are 6 each in the IF section behind the 8 octaves of RF cans at the front of the RF deck.

The original R390 had different slugs in the various sections of the 8 Octaves. So all 24 were not the same. But any three in an octave are the same.

R390 and R390/A slug sizes are all the same.
The spring wire can be soldered and or glued back together.
Original slugs were all spline.

If you have a slotted slug bolt it is not likely original.
It may have the original slug under it and it could be a repair.
It could be a late year replacement part. Being easier to put a slotted bolt on the slug than to obtain the spline bolts.

If it operates well let it be.

If the octave will not align and peak as well as the other octaves, then post a request here for one replacement. Several of the Fellows have some spare parts and for a reasonable cost and postage will send you a good replacement.

The slugs did have color coded paint dots on them.

There were lots of differences. The color dots were not any assurance the slugs were correct. The only real test was to install a slug. Do the alignment and power measurements. If the receiver worked to spec the slug was acceptable.

You may see different paint dots on the slugs within a given receiver.

Roger AI4NI

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[R-390] R-390 IF Mod Identification

Don Heywood wc4g at knology.net
Sun May 17 13:24:56 EDT 2009

- Previous message: [R-390] Sources for HP410C AC Probe
- Next message: [R-390] Pearls
- **Messages sorted by:** [date] [thread] [subject] [author]

HI guys, I have an R-390/URR here which has an unknown mod in the IF deck.

Here is what I can see:
The BFO on/off switch has been replaced by a three position switch with three leads (in addition to the BFO B+ contacts).
These three leads enter the back edge of the IF deck through a three pin inline cinch connector so the deck can still be removed.
There is an R/C network tucked in around the base of IF transformer T505.
One of the three extra leads goes to what I think is the BFO coupling cap area. This cap has been clipped and these leads attached to the above circuitry..
The second extra lead also connects to the extra circuitry around T505
The third extra lead has been placed in series with the original lead to pin 1 of V510.
Has anyone seen or have information on this mod. My plans are to uninstall it and return the deck to original.

The benefit of your experience will be appreciated.

Don WC4G
Charleston, SC

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